ARE THERE UNDISCOVERED PRINCIPLES OF NATURE: NEW SYMMETRIES, NEW PHYSICAL LAWS?

WHAT IS THE NATURE OF THE UNIVERSE AND WHAT IS IT MADE OF?

CAN WE PRODUCE AND DETECT DARK MATTER, WHOSE MYSTERIOUS PARTICLES FORM 25% OF THE UNIVERSE?

With 800 collaborators representing 62 institutions and 12 countries, CDF in Run 2 at the Fermilab Tevatron is challenging the standard model while searching for dark matter, supersymmetry and other exotic phenomena.

The Tevatron produces several hundred thousand proton-antiproton collisions per second in the center of CDF. CDF will record thousands of top pair events, like the one pictured above, in Run 2.

DOES THIS STRIKINGLY SIMPLE PICTURE OF NATURE’S FUNDAMENTAL PARTICLES TELL THE WHOLE STORY?

Discoveries at CDF—the 175 GeV top quark in 1995, the precision measurement of B mesons and W bosons—have helped to shape the Standard Model, the theory that embodies our most profound understanding of the particles and forces of matter.

Exploring the Higgs will help us understand the mystery of matter-antimatter asymmetry.

CDF scientists look for signals for new particles using characteristic signatures, like those of the tau, the heaviest lepton, and the top, the heaviest quark.

Today, CDF measurements of the masses of the W boson and the top quark probe the origin of mass itself and the nature of the Higgs boson.

Exploring B mesons will help unlock the mystery of matter-antimatter asymmetry.

THE STANDARD MODEL AND BEYOND

DETECTOR UPGRADES

01 NEW SCINTILLATOR TILE END CAP CALORIMETER
02 NEW CALORIMETER FRONT END ELECTRONICS
03 NEW CENTRAL OUTER TRACKER FOR CHARGED PARTICLE MOMENTUM
04 NEW SCINTILLATOR BARREL CALORIMETER — THE WORLD’S LARGEST
05 IMPROVED MUON DETECTOR COVERAGE
06 NEW MEDIUM-TO-LOW MOMENTUM TRACKER
07 NEW MEDIUM-TO-LOW MOMENTUM TRACKER
08 NEW TRIGGER ELECTRONICS, INCLUDING TRIGGER FOR SECONDARY VERTICES
09 NEW RECONSTRUCTION AND SIMULATION SOFTWARE
10 NEW DATA ACQUISITION SYSTEM

LEFT TO RIGHT

CDF SILICON VERTEX DETECTOR BEING INSTALLED AT B-ZERO
CDF CONTROL ROOM
SIMULATION OF HIGGS EVENT PHYSICIST WITH SILICON BARREL

THE FERMILAB TEVATRON,

in Batavia, Illinois, [outside] in the world’s highest energy proton-antiproton collider. The six kilometer ring has 1,000 superconducting magnets cooled with liquid helium.

High-energy electron and neutrino from W

B QUARK JET, 1000 GEV ELECTRON

B QUARK JET, 1000 GEV ANTIPROTON

JETS

JETS